There's More Out There! A Realistic Approach to a Painful First Metatarsophalangeal Joint

Deana Lewis B.S.[1] , Hamidat Momoh B.S.[2], Yasmin Radzi B.S.[2], Brennan Reardon B.S.[1]

1. Third Year Medical Student, Kent State University College of Podiatric Medicine, Independence, OH
2. Second Year Medical Student, Kent State University College of Podiatric Medicine, Independence, OH

Statement of Purpose

First metatarsophalangeal joint arthrodesis has been utilized as the gold standard and main approach for patients with a painful first metatarsophalangeal joint. However, joint implants may be a more viable approach as opposed to arthrodesis for establishing a pain free range of motion of the first metatarsophalangeal joint. This case series documents the number of hemi-implant patients, rate of subsequent surgery, patient demographics, and follow-up time from 2008-2019. In this study we assessed the reliability of hemi-implants as treatment for hallux limitus or rigidus.

Introduction and Literature Review

The ideal surgical procedure for the management of symptomatic hallux limitus and rigidus remains a controversial subject amongst surgeons. Although successful in many cases, first metatarsophalangeal arthrodesis has been reported to provide patients with alterations in gait patterns with longer recovery times, which can limit the patient's daily activities. The current literature suggests that first metatarsophalangeal joint implants may provide patients with less joint pain, ability to ambulate almost immediately post-surgery as well as increased function at the joint with shorter recovery time.

For many decades there has been a matter of debate of which surgical procedure between arthroplasty and arthrodesis, is best to treat hallux limitus and rigidus conditions . Patients most commonly report of pain in the region of their first toe, difficulties purchasing shoegear and limitations in the distance that they can walk [1, 10]. Many articles have shown the debate between both procedures and their efficacy in treating such conditions. Arthrodesis has largely become the gold standard in treating first metatarsophalangeal joint pain with an arthroplasty as an alternative option [3,10]. When comparing both procedures, in patients over the age of 45 years old and a follow up time of 2 years, it has been found that patient satisfaction was high for either procedure and found that 75% expressed complete satisfaction and 98% with some improvement. First metatarsophalangeal joint pain was completely removed in 90% of the patients overall [7]. Based on those results, the Keller arthroplasty provided the same amount of pain relief as the arthrodesis and it still provides a range of motion for the patient that the arthrodesis will not provide [7].

A recent meta-analysis conducted in 2018 observed that although implant arthroplasty and arthrodesis of the first metatarsophalangeal joint led to similar clinical outcomes, significantly lower pain in the arthrodesis cohort was also reported. The fact that this meta-analysis revealed that arthrodesis and joint arthroplasty showed similar clinical outcomes supports the fact that joint arthroplasty can also provide optimal outcomes as the arthrodesis method, and can further benefit the patient in providing motion at the joint [5,7]. There were a number of non unions with the arthrodesis procedures, 44% requiring revisions. O'Doherty mentions that physicians mainly choose the arthrodesis procedure based on being more familiar with it than the arthroplasty. Being more familiar with a procedure and based on how the physician was trained, could be a reason as to why the arthrodesis is usually the procedure of choice amongst surgeons, this however does not always mean it's the best option. The Keller arthroplasty gave good results and had advantages such as simplicity and a low incidence of complications with low revision rates. Thus, the results of this study concluded that a Keller arthroplasty was a better choice for 1st metatarsophalangeal joint pain in the older patient [7].

Literature Review

When looking at the hemi-implants themselves, a retrospective study of 53 patients was performed to evaluate patient outcomes of metallic hemi-implants of the great toe. In order to evaluate post-operative outcomes a subjective questionnaire, AAOS Foot and Ankle Questionnaire and the Hallux Metatarsal-Interphalangeal Scale were used. The average increase in ROM was 29.3 degrees and on a subjective pain scale patients' pain decreased from 6.7 +/- 2.6 to 2.5 +/- 2.8 post-operatively and 80% of patients stated they would have the surgery done again if needed. Only 2 of the 53 patients had their implants removed [3]. A long term study was performed comparing and contrasting arthroplasty and arthrodesis and had favorable outcomes for the arthroplasty with an average follow-up time of 8 years [1].

On the other hand, there are prior studies that observed optimal outcomes and patient satisfaction post-arthrodesis of the first metatarsophalangeal joint but these studies were conducted over a small study duration of less than two years which makes it difficult for clinicians to evaluate long term outcomes of the arthrodesis modality [5,9]. A longer duration study and meta-analysis comparing first MPJ implant arthroplasty and arthrodesis is necessary to learn more about how joint implant arthroplasty can benefit patients with hallux rigidus also with optimal patient outcomes while still providing motion at the joint [5].

Materials and Methods

A retrospective chart review was conducted at one outpatient center with all procedures performed by the same surgeon. The number of patients with hemi-implants, rate of subsequent surgery post implantation, and patient demographics were observed from 2008-2018. This time frame includes any initial implantation in 2008 to the last follow up date in 2019. Subsequent surgery was defined as any revision that was performed solely due to complications from the initial implant and was performed by the same surgeon. Patient charts were reviewed until the last documented office visit. There was no prior staging of hallux limitus or rigidus and patients who underwent subsequent procedures at the time of implant were included in this study. Different brands of hemi-implants were used for each procedure. No patients operated on in the timeframe above were excluded. Post operative course includes weight-bearing as tolerated in surgical shoe for 5-7 days.

Figure 1: Hemi-implant, superior view

Figure 2: Hemi-implant, side view

Figure 3: Hemi-implant of first metatarsophalangeal joint

Results

64 hemi-implant procedures in 62 different patients were reviewed. There were 51 female and 8 male patients that did not receive a subsequent procedure due to no implant complications. There were 3 patients that received a subsequent surgery due to implant complications (Table 1). All 3 patients that had a complication were female, white race, with an average age of 67 y/o, with an average weight of 145lbs. The rate of subsequent surgeries following initial implantation was **4.69%** in which no new implants were placed. The average follow up time for the 3 patients that had a subsequent surgery was 3.75 years. The implants were removed completely followed by a modified Keller or modified cheilectomy.

Patient	Follow-up Time (years)	Implant (L, R, or BL)	Age (years)	Weight (lbs)	Height (Inches)	Gender	Race
1	9	L	78	160	66	Female	White
2	N/A	R	N/A	N/A	N/A	Female	White
3	1.75	BL	65	130	66	Female	White
Average Rate of Subsequent Surgery (n=3)	*4.69%*						

Key: L (left), R (right), BL (bilateral), N/A (this data was not retrievable due to paper chart not obtained)

Table 1: Demographics of patients who received a subsequent surgery due to implant complications *(n=3)*.

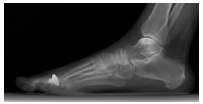

Figure 4: Lateral view of hemi-implant of first metatarsophalangeal joint

Figure 5: Plantar view of hemi-implant of first metatarsophalangeal joint

Figure 6: AP view of hemi-implant of the left foot

Discussion

First metatarsophalangeal joint implants are a beneficial and practical alternative to an arthrodesis of the first metatarsophalangeal joint when treating hallux rigidus or limitus. With hallux limitus or rigidus, loss of joint motion, joint degeneration, osteophytes, pain and soft tissue swelling can all arise. While controversy still exists in treatment of hallux rigidus and limitus, first metatarsophalangeal joint implants have been shown to provide similar outcomes similar to the arthrodesis modality, in factors of patient satisfaction, pain improvement and function.

Discussion

The joint implant-arthroplasty provided patients with optimal pain management and allowed for motion at the joint, unlike the arthrodesis modality in other studies. Out of the 62 patients, diagnosed with either hallux limitus or rigidus, underwent an implant procedure and only three required revisional surgery. With the use hemi-implants, patients are given the chance to maintain mobility at the first metatarsophalangeal joint while providing less or no pain at the joint. Additionally, maintaining motion at the joint post-implantation allows for better quality of life.

There are some limitations in the present study. Although the study ranges for **11 years**, follow up time length was impacted due to the possibility that patients did not come back because they were satisfied with the result. Patients also may have gone to a separate surgeon for revision. In addition, patients were not evaluated for level of pain at the visit, despite the possibility of feeling pain, the desire another surgery was not expressed.

Using only one podiatric physician's charts for data is a strength in the sense that all procedures were performed in a consistent manner and the post operative protocol was the same. This keeps a continuity of treatment, decreasing the chance of variability in technique compared to mixed surgeon data.

The cohort of patients who underwent subsequent surgery was **4.69% of 62 patients** over the 11-year study duration course suggests that the first metatarsophalangeal hemi-implant arthroplasty was a successful modality for hallux rigidus and limitus, for this sole podiatric surgeon. Although this was not a comparative study, future multi-center studies are warranted and a further comparison between first metatarsophalangeal arthrodesis and implant arthroplasty would be effective in understanding the superiority between both modalities.

This study shows that we can at the very least buy the patient time with motion, even if the implant fails and they have fusion later in life, they can have motion for a longer period of time. We did not evaluate motion of 1st MPJ and it is possible the implant was more a relief from a painful arthritic joint rather than allowing more motion.

In the final analysis, there is a great deal of evidence in the literature that favors the use of hemi-implants and proves that it is a viable option for treatment of hallux limitus or rigidus. The debate between the appropriate surgical procedure remains, however, we can back up reasoning for the use of hemi-implants and thus can use it as a roadmap in selecting the right procedure as well as predicting how the treatment will functionally improve surgical outcomes.

References

1. Beekhuizen, S. & Oosterik, R. (2017). Long-term Results of Hemiarthroplasty for Osteoarthritis of the First Metatarsophalangeal Joint. Foot & Ankle Orthopaedics, 2(3). doi: 10.1177/2473011417680011
2. Carpenter, B., Smith, J., Motley, T. & Garrett, A. (2010). Surgical Treatment of Hallux Rigidus Using a Metatarsal Head Resurfacing Implant: Mid-term Follow-up. The Journal of Foot and Ankle Surgery, 49(4), 321–325. doi: 10.1053/j.jfas.2010.04.005
3. D'Amico, Jennifer A, et al. "RETROSPECTIVE ANALYSIS OF METALLIC HEMI-ARTHROPLASTY OF THE GREAT TOE: An Outcomes Study." *Podiatry Institute*, 2010.
4. Kim, Paul J., et al. "A Multicenter Retrospective Review of Outcomes for Arthrodesis, Hemi-Metallic Joint Implant, and Resectional Arthroplasty in the Surgical Treatment of End-Stage Hallux Rigidus." *The Journal of Foot and Ankle Surgery*, vol. 51, no. 1, 2012, pp. 50–56., doi:10.1053/j.jfas.2011.08.009
5. Kumar, S., Pradhan, R., & Rosenfeld, P. F. (2010). First Metatarsophalangeal Arthrodesis using a Dorsal Plate and a Compression Screw. *Foot & Ankle International*, *31*(9), 797–801. doi: 10.3113/fai.2010.0797.
6. McGlamry, E. D., & Southerland, J. T. (2013). *McGlamry's comprehensive textbook of foot and ankle surgery*. Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins Health.
7. Oakberry, D., Lewitz, L., Magnussen, P., & Gregg, P. (1990). The management of the painful first metatarsophalangeal joint in the older patient. Arthrodesis or Kellers arthroplasty? *The Journal of Bone and Joint Surgery. British Volume*, *72-B*(5), 839–842. doi: 10.1302/0301-620x.72b5.2211767
8. Park, Y. H., Jung, J. H., Kang, S. H., Choi, G. W., & Kim, H. J. (2019). Implant Arthroplasty versus Arthrodesis for the Treatment of Advanced Hallux Rigidus: A Meta-analysis of Comparative Studies. *The Journal of Foot and Ankle Surgery*, *58*(1), 137–143. doi: 10.1053/j.jfas.2018.08.045
9. Ponce, B. A., & Hamilton, G. A. (2012). End-Stage Hallux Rigidus. *Clinics in Podiatric Medicine and Surgery*, *29*(3), 341–353. doi: 10.1016/j.cpm.2012.04.002
10. Stone, G. D., Ray, R., Thorrson, C. E., & Gibson, J. N. A. (2017). Long-Term Follow-up of Arthrodesis vs Total Joint Arthroplasty for Hallux Rigidus. *Foot & Ankle International*, *38*(4), 375–380.